



US009132976B2

(12) **United States Patent**  
**Fujii**

(10) **Patent No.:** **US 9,132,976 B2**  
(45) **Date of Patent:** **Sep. 15, 2015**

(54) **PAPER SEPARATING DEVICE AND IMAGE FORMING APPARATUS**

(56) **References Cited**

U.S. PATENT DOCUMENTS

(71) Applicant: **Kyocera Document Solutions Inc.**,  
Osaka (JP)  
(72) Inventor: **Hirokazu Fujii**, Osaka (JP)  
(73) Assignee: **Kyocera Document Solutions Inc.**,  
Osaka (JP)

6,785,503	B2 *	8/2004	Kuo et al.	399/323
2001/0016134	A1 *	8/2001	Park	399/397
2006/0182478	A1 *	8/2006	Miller et al.	399/398
2007/0223975	A1 *	9/2007	Yoshida	399/323
2007/0280752	A1 *	12/2007	Uchida	399/323
2008/0131177	A1 *	6/2008	Aratachi et al.	399/323

FOREIGN PATENT DOCUMENTS

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

JP 2012-128196 A 7/2012

\* cited by examiner

(21) Appl. No.: **14/484,615**

*Primary Examiner* — Thomas Morrison

(22) Filed: **Sep. 12, 2014**

(74) *Attorney, Agent, or Firm* — James W. Judge

(65) **Prior Publication Data**

US 2015/0108708 A1 Apr. 23, 2015

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Sep. 12, 2013 (JP) ..... 2013-189760

(51) **Int. Cl.**

**B65H 29/54** (2006.01)

**B65H 3/32** (2006.01)

**B65H 3/02** (2006.01)

**B65H 3/26** (2006.01)

(52) **U.S. Cl.**

CPC .. **B65H 3/32** (2013.01); **B65H 3/02** (2013.01);  
**B65H 3/26** (2013.01)

(58) **Field of Classification Search**

CPC ..... G03G 15/2085; G03G 15/6532

USPC ..... 399/323, 398, 399; 271/311, 312, 313

See application file for complete search history.

A paper separating device for separating a paper sheet includes a frame member, an image carrier, a securing plate, and two types of assemblies. The two types of assemblies include: a first assembly that includes a separation claw configured to separate the paper sheet from the image carrier, a guiding member configured to guide the paper sheet, and a holder with an engaging portion; and a second assembly that engages the guiding member alone to the holder with the engaging portion without holding the separation claw. The frame member and the securing plate each include an assembly securing portion with an engaged portion to be engaged with the engaging portion of the holder. One of the two types of assemblies is secured to the assembly securing portion disposed at the securing plate while another is secured to the assembly securing portion disposed at the frame member.

**9 Claims, 17 Drawing Sheets**

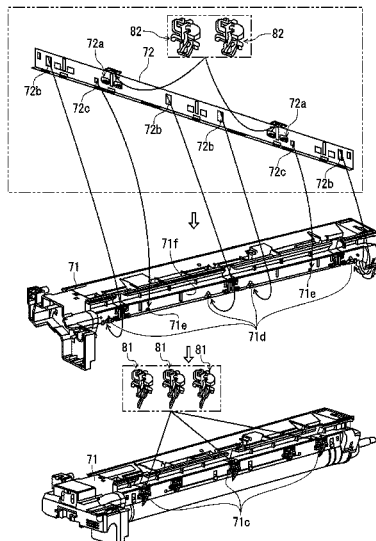


FIG. 1

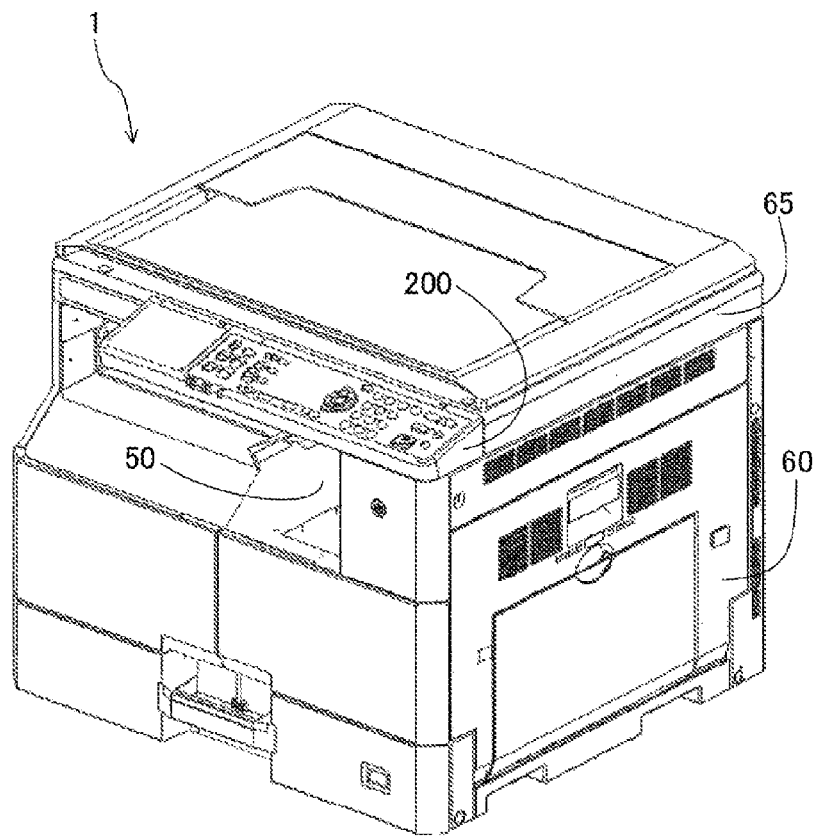


FIG. 2

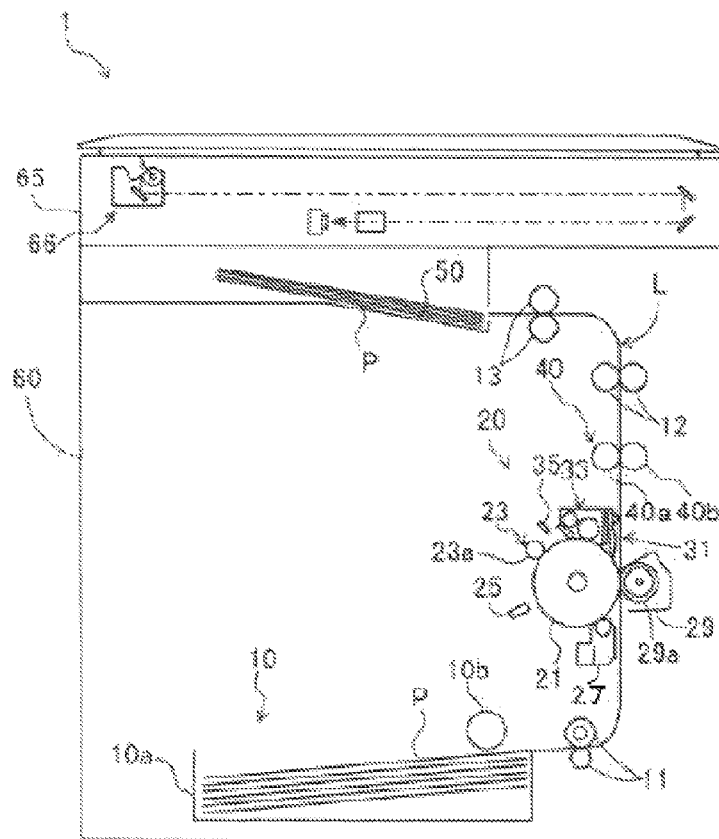


FIG. 3

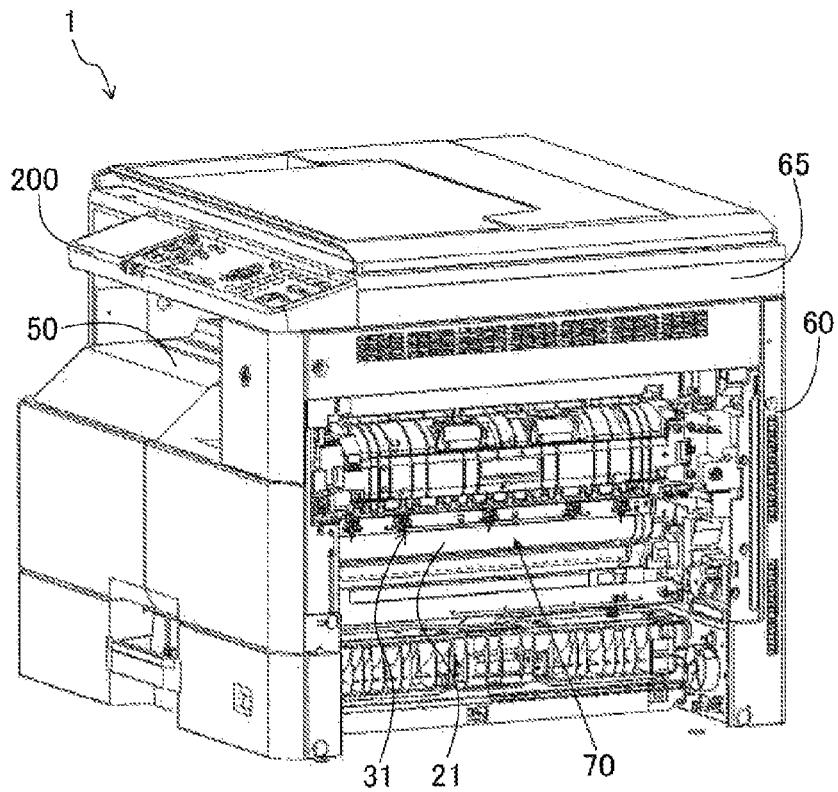


FIG. 4

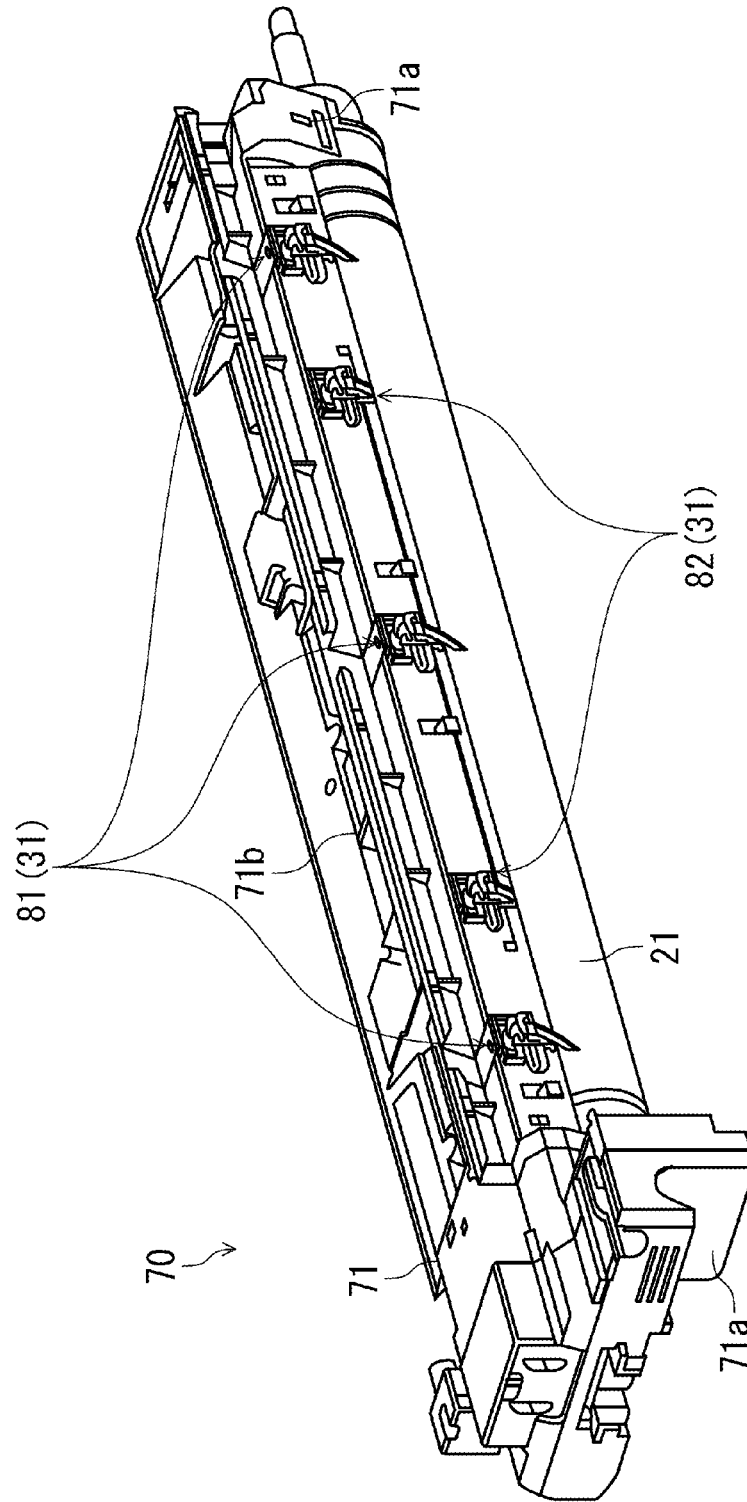


FIG. 5

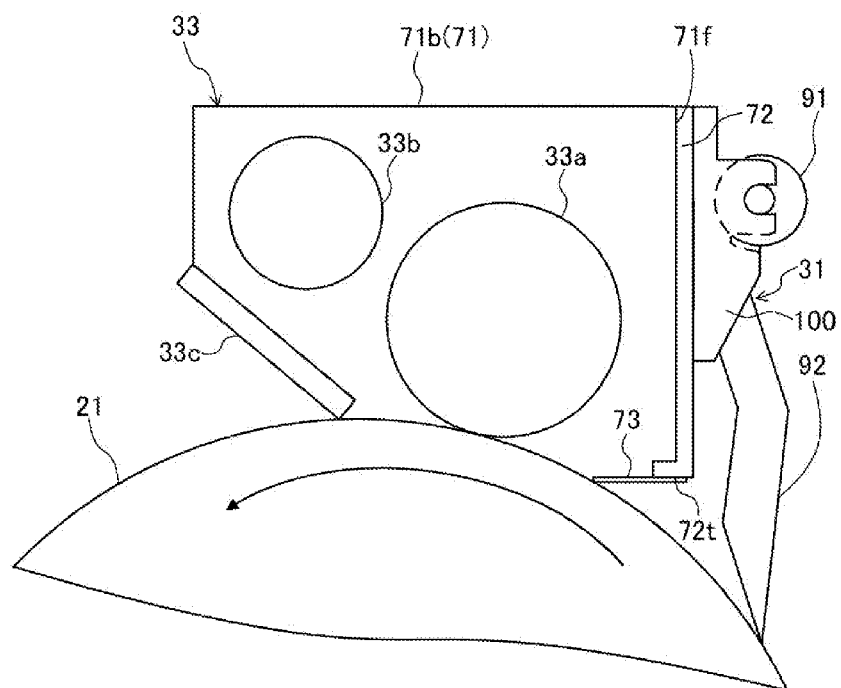


FIG. 6

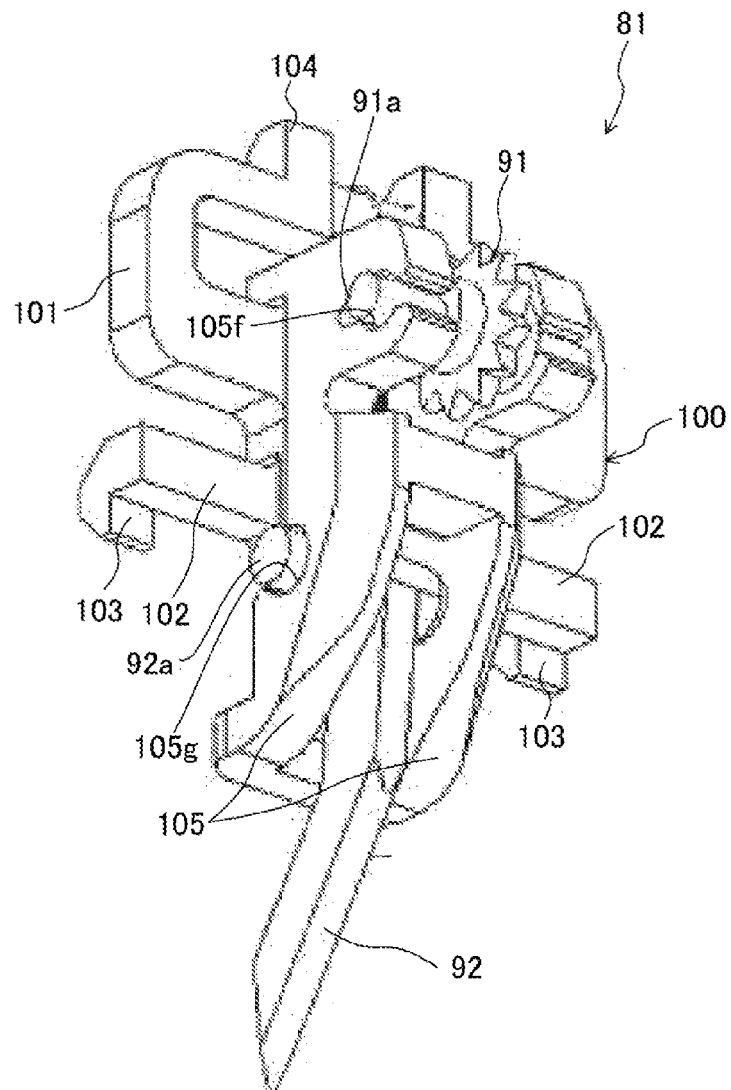


FIG. 7

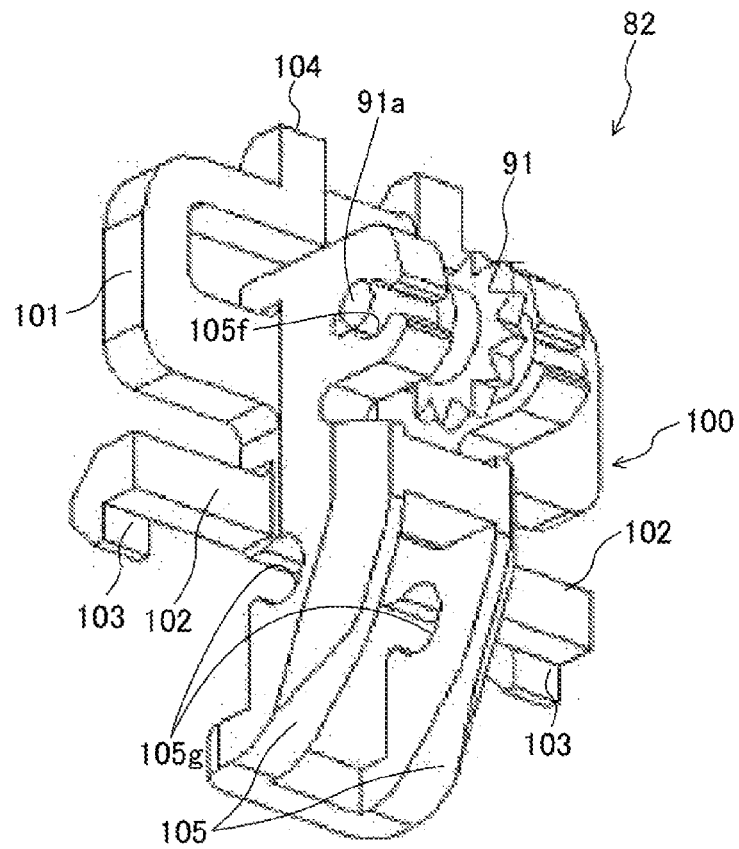
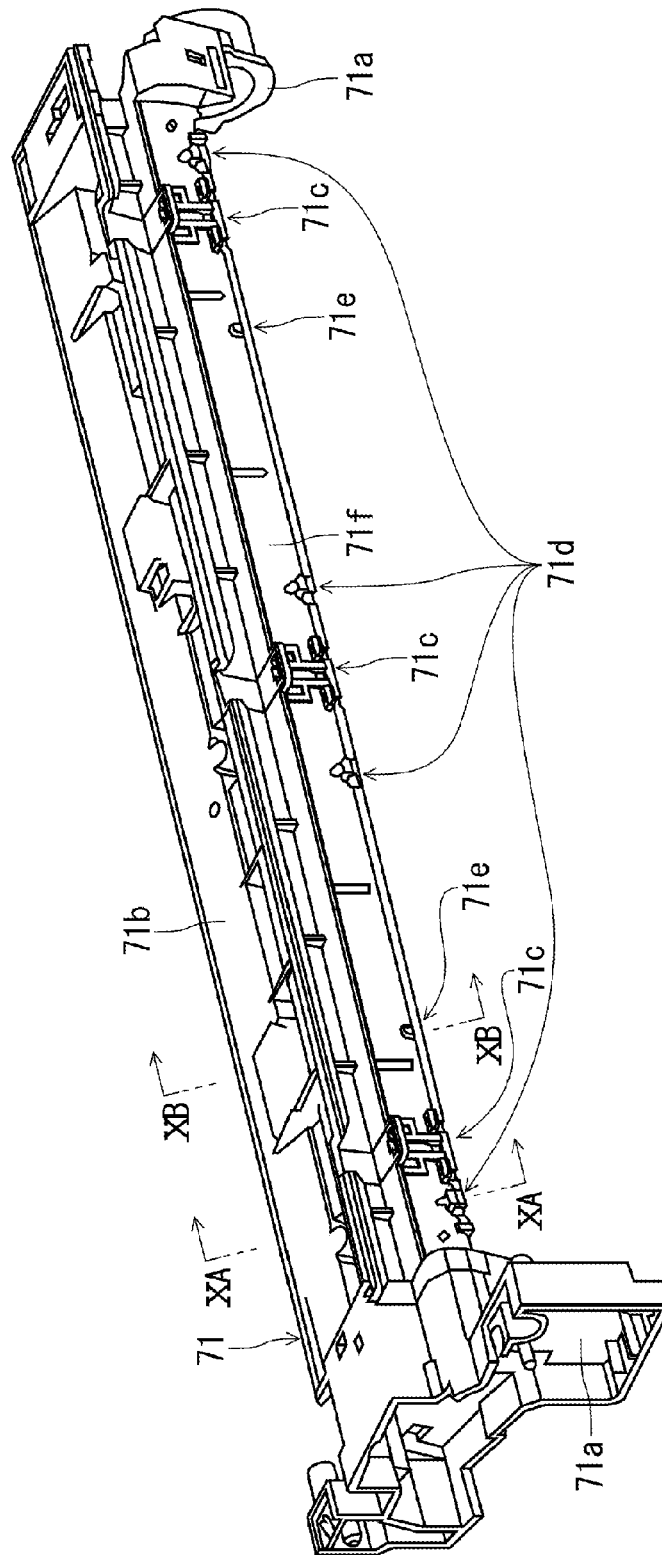




FIG. 8



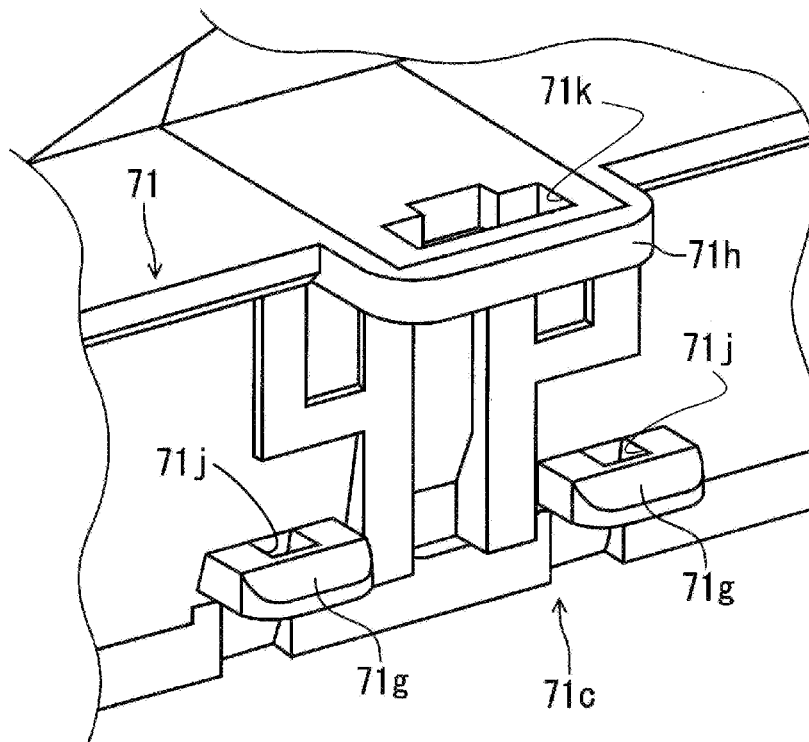
**FIG. 9**

FIG. 10A

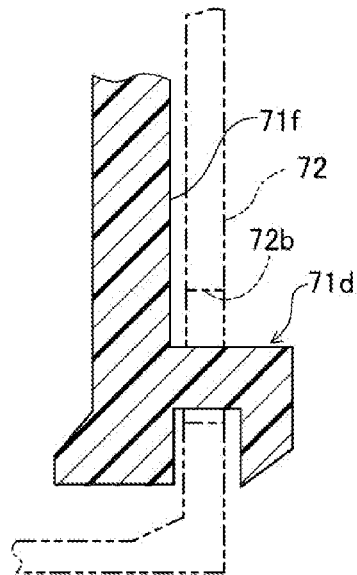


FIG. 10B

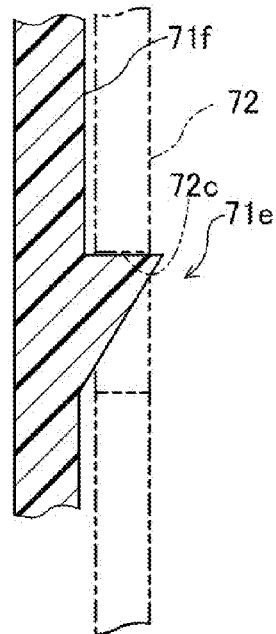


FIG. 11

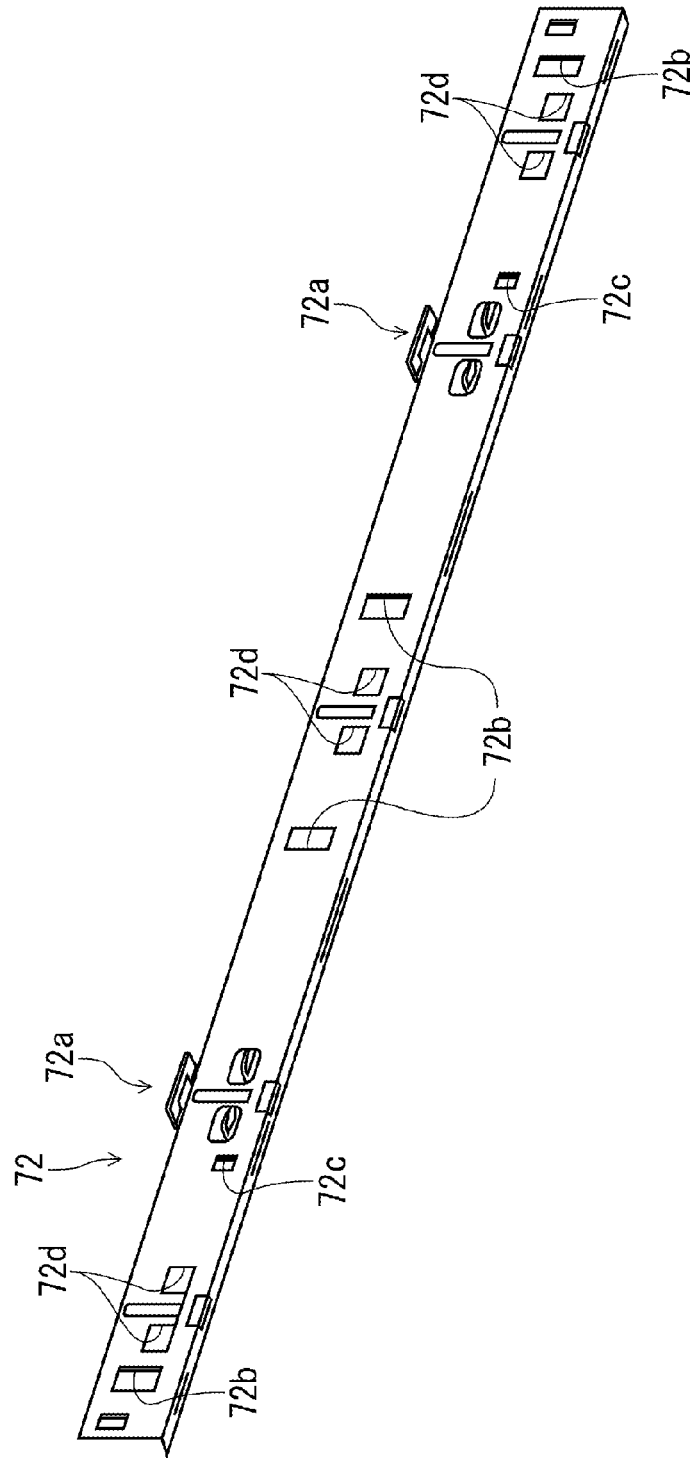


FIG. 12

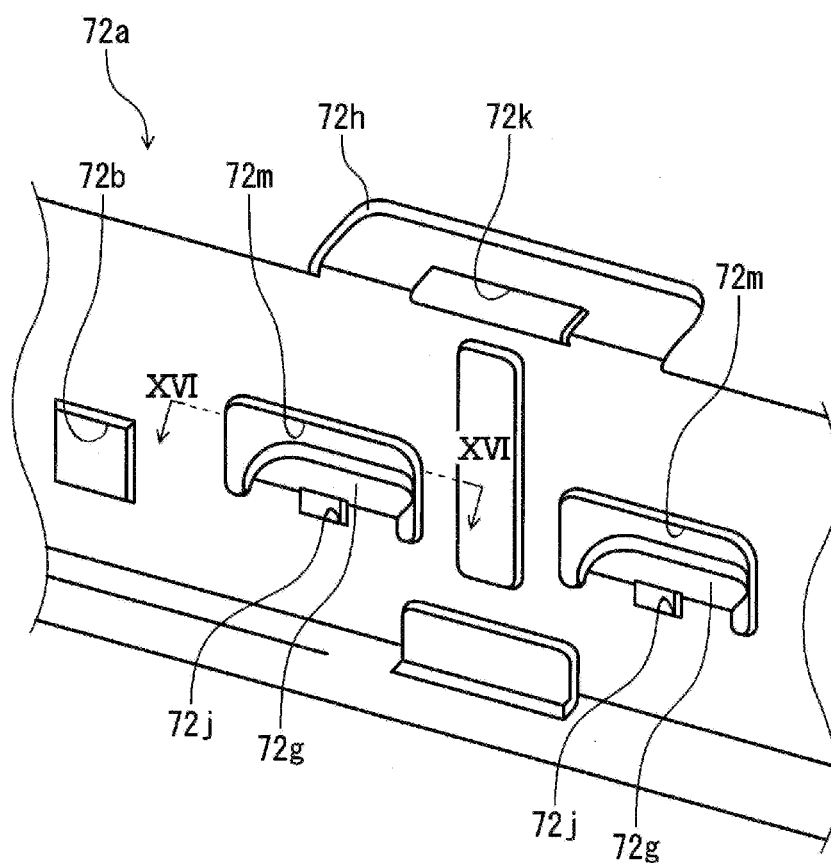


FIG. 13

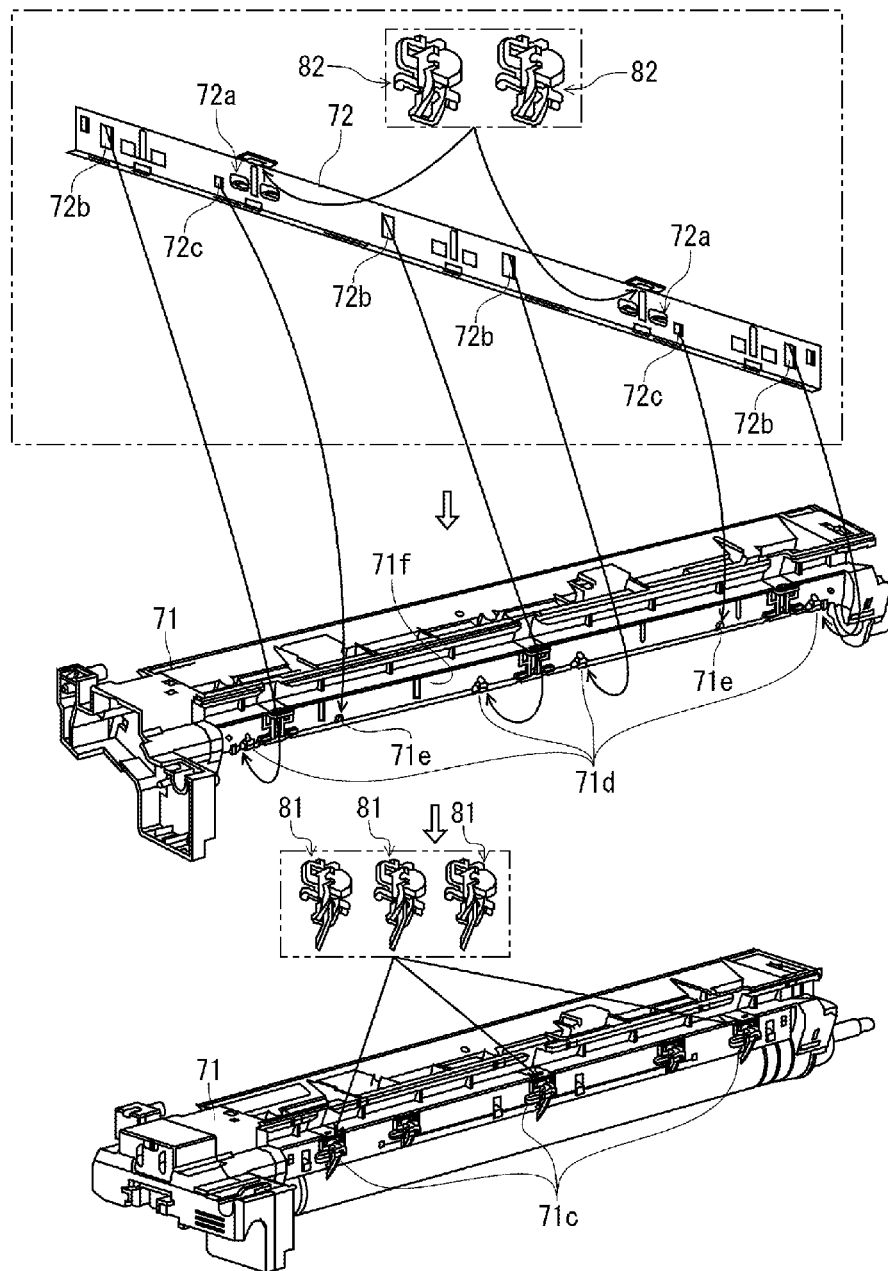


FIG. 14

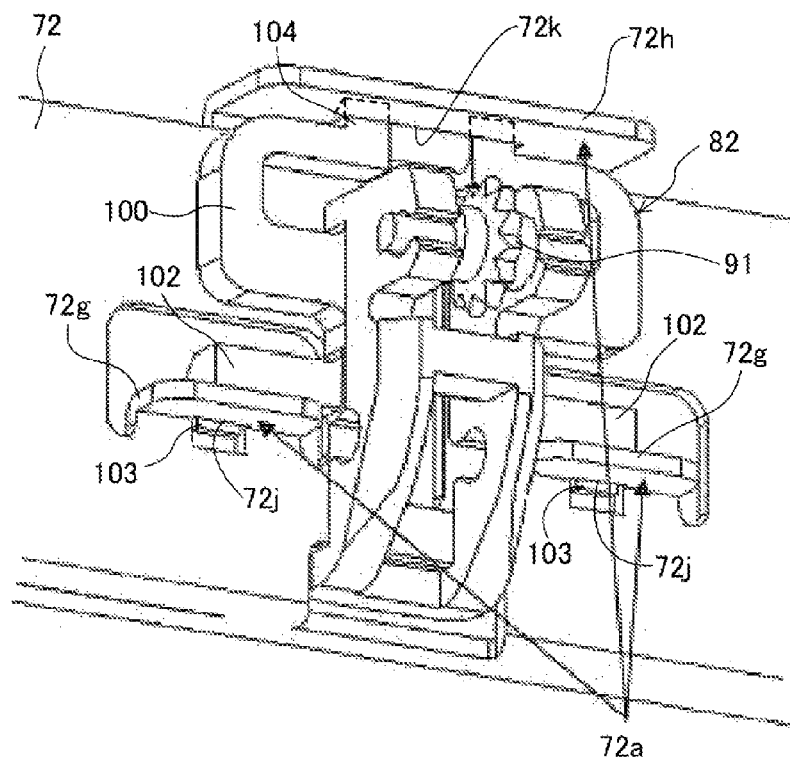


FIG. 15

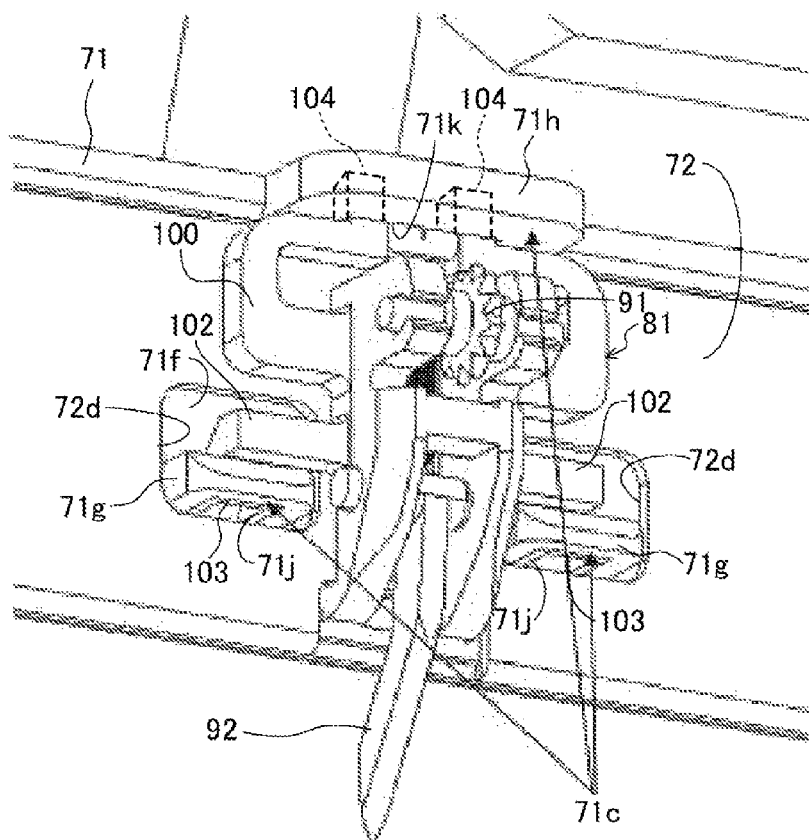




FIG. 16

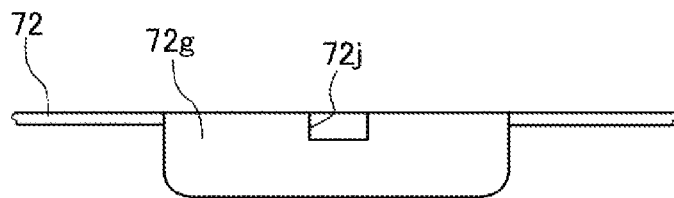
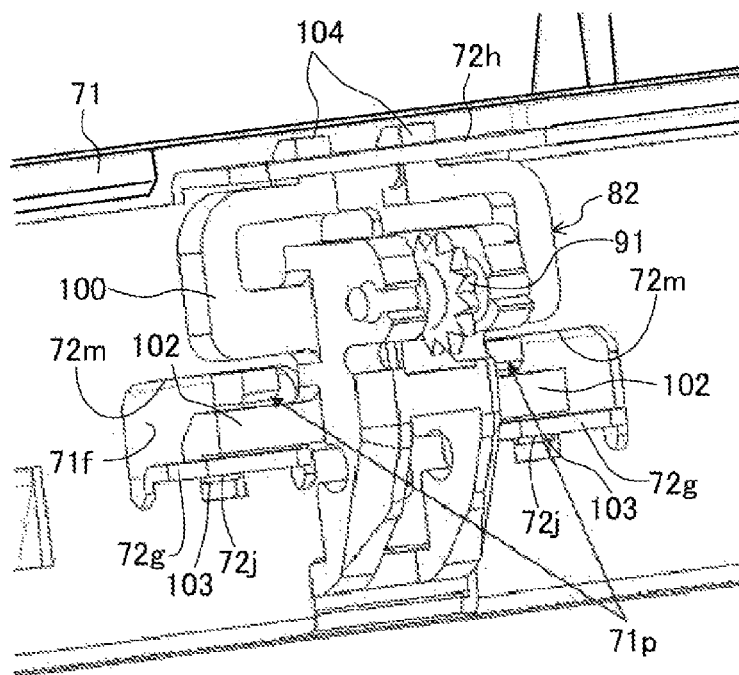


FIG. 17



# PAPER SEPARATING DEVICE AND IMAGE FORMING APPARATUS

## INCORPORATION BY REFERENCE

This application is based upon, and claims the benefit of priority from, corresponding Japanese Patent Application No. 2013-189760 filed in the Japan Patent Office on Sep. 12, 2013, the entire contents of which are incorporated herein by reference.

## BACKGROUND

Unless otherwise indicated herein, the description in this section is not prior art to the claims in this application and is not admitted to be prior art by inclusion in this section.

A known electrophotographic system image forming apparatus with a photoreceptor drum includes a separating device for separating a paper sheet from a drum circumferential surface. The separating device includes a plurality of separation claws having distal end portions in contact with the circumference surface of the photoreceptor drum. Each separation claw is held by a holder together with a guiding roller for guiding the paper sheet as an assembly. The respective assemblies are arranged at a distance from each other in the axial direction of the photoreceptor drum. In a drum frame that supports the photoreceptor drum, a securing portion for securing each assembly is formed. This securing portion is constituted of a plurality of projecting portions and engaging hole portions formed in the projecting portions. Each assembly is secured to the drum frame such that an engaging claw formed in the holder is engaged with the engaging hole portion formed in the above-described projecting portion.

## SUMMARY

A paper separating device for separating a paper sheet according to the disclosure include a frame member, an image carrier, a securing plate, and two types of assemblies. The image carrier is rotatably supported by the frame member and rotatable in abutting contact with a paper sheet. The securing plate is to be removably mounted on the frame member. The two types of assemblies include a first assembly and a second assembly. The first assembly includes: a separation claw configured to separate the paper sheet from the image carrier; a guiding member configured to guide the paper sheet; and a holder with an engaging portion. The holder holds the separation claw and the guiding member. The second assembly that engages the guiding member alone to the holder with the engaging portion without holding the separation claw. The frame member and the securing plate each include an assembly securing portion with an engaged portion to be engaged with the engaging portion of the holder. One of the two types of assemblies is secured to a second assembly securing portion disposed at the securing plate while another is secured to a first assembly securing portion disposed at the frame member.

These as well as other aspects, advantages, and alternatives will become apparent to those of ordinary skill in the art by reading the following detailed description with reference where appropriate to the accompanying drawings. Further, it should be understood that the description provided in this summary section and elsewhere in this document is intended to illustrate the claimed subject matter by way of example and not by way of limitation.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 perspectively illustrates a copier as an image forming apparatus that includes a paper separating device according to a first embodiment;

FIG. 2 schematically illustrates an internal structure of the copier according to the first embodiment;

FIG. 3 perspectively illustrates a state where a right-side cover of the copier according to the first embodiment is removed;

FIG. 4 perspectively illustrates a photoreceptor drum unit according to the first embodiment;

FIG. 5 cross-sectionally illustrates an enlarged outline of a cleaning unit located in a drum frame according to the first embodiment;

FIG. 6 perspectively illustrates a first assembly according to the first embodiment;

FIG. 7 perspectively illustrates a second assembly according to the first embodiment;

FIG. 8 perspectively illustrates the drum frame according to the first embodiment;

FIG. 9 perspectively illustrates an enlarged first-assembly securing portion formed in the drum frame according to the first embodiment;

FIG. 10A illustrates a cross section taken along the line XA-XA in FIG. 8;

FIG. 10B illustrates a cross section taken along the line XB-XB in FIG. 8;

FIG. 11 perspectively illustrates a securing plate according to the first embodiment;

FIG. 12 perspectively illustrates an enlarged second-assembly securing portion formed in the securing plate according to the first embodiment;

FIG. 13 describes an assembly procedure of the first and second assemblies to the drum frame according to the first embodiment;

FIG. 14 perspectively illustrates a state where the second assembly is assembled to the second-assembly securing portion formed in the securing plate according to the first embodiment;

FIG. 15 perspectively illustrates a state where the first assembly is assembled to the first-assembly securing portion in the drum frame according to the first embodiment;

FIG. 16 illustrates a cross section taken along the line XVI-XVI in FIG. 12; and

FIG. 17 perspectively illustrates a state where a second assembly is assembled to a drum unit according to a second embodiment.

## DETAILED DESCRIPTION

Example apparatuses are described herein. Other example embodiments or features may further be utilized, and other changes may be made, without departing from the spirit or scope of the subject matter presented herein. In the following detailed description, reference is made to the accompanying drawings, which form a part thereof.

The example embodiments described herein are not meant to be limiting. It will be readily understood that the aspects of the present disclosure, as generally described herein, and illustrated in the drawings, can be arranged, substituted, combined, separated, and designed in a wide variety of different configurations, all of which are explicitly contemplated herein.

Hereafter, a detailed description will be given of embodiments of the disclosure with reference to the drawings. The disclosure will not be limited to the embodiments described below.

#### First Embodiment

FIG. 1 illustrates a digital copying machine 1 (hereinafter referred to simply as a copier) as an image forming apparatus that includes a paper separating device 31 in this embodiment. This copier 1 includes a main-body housing portion 60 and a scanner housing portion 65 arranged on the upper side of the main-body housing portion 60. The scanner housing portion 65 internally houses a scanner unit 66 (see FIG. 2) for reading a document image. The main-body housing portion 60 internally houses an image forming unit 20 for printing the document image read by the scanner unit 66 on a paper sheet P. On the side surface of the scanner housing portion 65, an operation panel 200 for a user to issue various operation instructions to the copier 1 is located.

As illustrated in FIG. 2, the main-body housing portion 60 internally houses a paper sheet feeder 10, the image forming unit 20, and a fixing unit 40. In the top surface portion of the main-body housing portion 60, a discharging unit 50 is formed. On a sheet conveying path L from the paper sheet feeder 10 to the discharging unit 50, a plurality of conveyance roller pairs 11 to 13 for sandwiching and conveying the paper sheet P are arranged.

The above-described paper sheet feeder 10 is arranged in the lower portion within the main-body housing portion 60. The paper sheet feeder 10 includes a sheet feed cassette 10a and a pickup roller 10b. The sheet feed cassette 10a houses the sheet-shaped paper sheet P. The pickup roller 10b takes out the paper sheet P within the sheet feed cassette 10a and sends the paper sheet P to the outside of the cassette. The paper sheet P sent to the outside of cassette from the sheet feed cassette 10a is supplied to the image forming unit 20 via the conveyance roller pair 11. In the image forming unit 20, a toner image based on predetermined image data is transferred to the paper sheet P supplied by the paper sheet feeder 10. The paper sheet P is supplied to the fixing unit 40. In the fixing unit 40, the paper sheet P supplied by the image forming unit 20 is pressed between a fixing roller 40a and a pressure roller 40b to fix the toner image to the paper sheet P. Then, the paper sheet P to which the toner image is fixed by the fixing unit 40 is sent out to the downstream side by both rollers 40a and 40b. The paper sheet P sent out by the fixing unit 40 is discharged to the above-described discharging unit 50 via the plurality of conveyance roller pairs 12 and 13.

The above-described image forming unit 20 includes a photoreceptor drum 21. In the peripheral area of the photoreceptor drum 21, with reference to the ten o'clock direction, a charger 23, an exposure apparatus 25, a developing unit 27, a transfer unit 29, the paper separating device 31, a cleaning apparatus 33, and a static eliminator 35 are arranged anti-clockwise in the drawing in this order.

The above-described charger 23 uniformly charges the circumference surface of the photoreceptor drum 21 via a charging roller 23a. The above-described exposure apparatus 25 irradiates a laser beam to the circumference surface of the photoreceptor drum 21 to form an electrostatic latent image corresponding to the predetermined image data.

The above-described developing unit 27 supplies toner to the electrostatic latent image on the circumference surface of the photoreceptor drum 21 for visualization as a toner image. The transfer unit 29 applies a transfer bias to a transfer roller

29a to transfer the toner image formed on the circumference surface of the photoreceptor drum 21 to the paper sheet P.

As illustrated in FIG. 3 and FIG. 4, the photoreceptor drum 21, the paper separating device 31, and the cleaning apparatus 33 are unitized via a drum frame 71 so as to constitute a drum unit 70.

The above-described drum frame 71 includes a pair of sidewall portions 71a and a cleaning case portion 71b. The pair of sidewall portions 71a rotatably supports both the end portions of the photoreceptor drum 21 in the axial direction. The cleaning case portion 71b is disposed across both the sidewall portions 71a. The cleaning case portion 71b constitutes the outer wall portion of the cleaning apparatus 33.

As illustrated in FIG. 5, the cleaning apparatus 33 includes a rubbing roller 33a, a transport screw 33b, and a cleaning blade 33c. The rubbing roller 33a and the transport screw 33b are housed within the cleaning case portion 71b. The rubbing roller 33a rotates in abutting contact with the photoreceptor drum 21 to scrape off foreign objects such as corona products attached to the circumference surface of the photoreceptor drum 21. The cleaning blade 33c is mounted on the downstream end of the cleaning case portion 71b in the drum rotation direction. The cleaning blade 33c brings its own distal end portion into contact with the circumference surface of the photoreceptor drum 21 to scrape off residual toner attached to the circumference surface of the photoreceptor drum 21. The toner scraped off by the cleaning blade 33c is discharged to a toner recovery container (not illustrated) located outside of the cleaning apparatus 33 by the transport screw 33b.

In the cleaning case portion 71b, the end surface on the upstream side in the drum rotation direction is designed to be a vertical surface in a rectangular shape extending in the axial direction of the photoreceptor drum 21. This end surface on the upstream side constitutes a securing-plate mounting surface 71f for mounting a securing plate 72 on the cleaning case portion 71b (the drum frame 71). The lower end portion of the securing plate 72 is folded in an L shape toward the inner side of the cleaning case portion 71b so as to form a seal mounting portion 72t. On the seal mounting portion 72t, a film-shaped sealing member 73 is mounted. The sealing member 73 is constituted by, for example, a polyethylene terephthalate (PET) film. The sealing member 73 is formed in a rectangular shape extending in the axial direction of the photoreceptor drum 21. One long-side portion of the sealing member 73 is secured to the seal mounting portion 72t while the other long-side portion is in abutting contact with the circumference surface of the photoreceptor drum 21. Thus, the sealing member 73 prevents leakage of the toner within the cleaning case portion 71b from the gap between the cleaning case portion 71b and the photoreceptor drum 21 to the upstream side of the drum rotation direction.

The above-described paper separating device 31 has a function that separates the paper sheet P from the circumference surface of the photoreceptor drum 21 and guides the paper sheet P to the downstream side in the paper sheet conveyance direction such that the paper sheet P does not flow into the cleaning case portion 71b. Specifically, the paper separating device 31 includes a first assembly 81 and a second assembly 82. The first assembly 81 has both a paper separating function and a paper guiding function. The second assembly 82 has the paper guiding function only. Both the assemblies 81 and 82 include common (same) holders 100. In the following description, unless it is explicitly stated otherwise, both the assemblies 81 and 82 are described to be in a state (a state in FIG. 3) assembled to the drum unit 70 within the copier 1.

5

As illustrated in FIG. 6, the first assembly **81** is constituted such that the holder **100** holds a separation claw **92** and a guiding roller **91**. The holder **100** includes a holder main body **101**, a pair of arm portions **102**, a pair of engaging claws **103**, a pair of engaging claws **104**, and a pair of vertical plate portions **105**. The holder main body **101** forms an approximately T-shaped frame. The pair of the arm portions **102** extend from the lower end portion of the holder main body **101** toward both sides of the drum axial direction. The respective arm portions **102** are constituted to be flexible in the up-down direction. The pair of the engaging claws **103** project from the respective distal end portion of the pair of the arm portions **102** to the lower side. The pair of engaging claw **104** projects from the upper end portion of the holder main body **101** to the upper side.

The above-described pair of vertical plate portions **105** is secured to one side in the thickness direction of the holder main body **101**. Both the vertical plate portions **105** are arranged at a distance from each other in the drum axial direction. In the upper end portion of each vertical plate portion **105**, a first bearing hole portion **105f** passing through in the drum axial direction is formed. This first bearing hole portion **105f** is rotatably fitted with a support shaft **91a** of the guiding roller **91**. In the intermediate portion in the up-down direction of each of the vertical plate portions **105**, a second bearing hole portion **105g** is formed. This second bearing hole portion **105g** is rotatably fitted with a support shaft **92a** of the separation claw **92**.

The circumference surface of the guiding roller **91** has a saw-teeth shape where depressed portions and protruding portions are alternately arranged in the circumferential direction. This reduces the contacted area between the guiding roller **91** and the paper sheet P as much as possible, thus reducing attachment of toner to the guiding roller **91** before the toner is thermally fixed to the paper sheet P.

The separation claw **92** is biased around the support shaft **92a** by a biasing member (not illustrated) such that the distal end portion of the separation claw **92** is brought into pressure contact with the circumference surface of the photoreceptor drum **21**.

As illustrated in FIG. 7, the second assembly **82** is constituted such that the holder **100** holds the guiding roller **91** alone. The second assembly **82** has the configuration where the holder **100** does not hold the separation claw **92**. The configuration is otherwise similar to that of the above-described first assembly **81**. Therefore, the detailed description of the second assembly **82** is omitted.

As illustrated in FIG. 8, on the securing-plate mounting surface **71f** of the drum frame **71** (the cleaning case portion **71b**), a first securing-plate latching portion **71d**, a second securing-plate latching portion **71e**, and a first-assembly securing portion **71c** are formed. Four of the above-described first securing-plate latching portions **71d** are formed in total, and are formed at a distance from one another in the drum axial direction. Three of the first-assembly securing portions **71c** are formed in total, and are formed one by one between the respective securing-plate latching portions **71d**. Two of the above-described second securing-plate latching portions **71e** are formed in total, and are formed one by one on both sides of the first-assembly securing portion **71c** sandwiched in the center.

As illustrated in FIG. 9, the first-assembly securing portions **71c** each include a pair of frame-side first projecting portions **71g** and a frame-side second projecting portion **71h**. The above-described pair of the frame-side first projecting portions **71g** are formed in rectangular block shapes extending in the drum axial direction. Both the frame-side first

6

projecting portions **71g** are formed at a distance from each other in the drum axial direction. In each of the frame-side first projecting portions **71g**, a frame-side first engaging hole **71j** passing through in the thickness direction (the up-down direction) is formed.

The above-described frame-side second projecting portion **71h** is arranged at a distance from the frame-side first projecting portions **71g** at the upper side. The frame-side second projecting portion **71h** is arranged across both the frame-side first projecting portions **71g** viewed from the upper side. The frame-side second projecting portion **71h** is formed in a rectangular block shape extending in the drum axial direction. In the frame-side second projecting portion **71h**, a frame-side second engaging hole **71k** passing through in the thickness direction (the up-down direction) is formed. To the first-assembly securing portion **71c** constituted as described above, the above-described first assembly **81** is assembled and secured as described later.

As illustrated in FIG. 10A, the above-described first securing-plate latching portion **71d** is formed with a U-shaped cross section opening downward. The peripheral edge portion of a first mounting hole **72b** formed in the securing plate **72** gets into a U-shaped groove of this first securing-plate latching portion **71d** to regulate the movement of the securing plate **72** in the lateral direction of the drawing. As illustrated in FIG. 10B, the second securing-plate latching portion **71e** is constituted by a columnar body in a rectangular triangle shape viewed from the drum axial direction. This second securing-plate latching portion **71e** fits into the second mounting hole **72c** formed in the securing plate **72** to regulate the movement in the up-down direction of the securing plate **72**. Thus, the securing plate **72** is removably mounted on the securing-plate mounting surface **71f** via the first and second securing-plate latching portions **71d** and **71e**.

As illustrated in FIG. 11, the securing plate **72** includes pairs of insertion holes **72d** and second-assembly securing portions **72a**. Three pairs of insertion holes **72d** are formed in total, and arranged at regular intervals from one another in the drum axial direction. Two of the second-assembly securing portions **72a** are formed in total, and are formed one by one between the three pairs of insertion holes **72d**. In the lateral direction of the second-assembly securing portions **72a**, the respective above-described second mounting holes **72c** are formed. Four of the above-described first mounting holes **72b** are formed in total, and are arranged at regular intervals from one another in the drum axial direction.

As illustrated in FIG. 12, the second-assembly securing portion **72a** includes a pair of securing-plate-side first projecting portions **72g** and a securing-plate-side second projecting portion **72h**. The above-described pair of the securing-plate-side first projecting portions **72g** are formed by plate-shaped pieces extending in the drum axial direction, and are arranged at a distance from each other in the drum axial direction. Each of the securing-plate-side first projecting portions **72g** is formed by cutting out and folding a part of the securing plate **72**. In the securing plate **72**, this cutout region is formed as a pair of through-holes **72m**. In the base end portion of the securing-plate-side first projecting portion **72g**, a securing-plate-side first engaging hole **72j** (see FIG. 16) is formed.

The above-described securing-plate-side second projecting portion **72h** is arranged at a distance from the above-described securing-plate-side first projecting portions **72g** at the upper side. The securing-plate-side second projecting portion **72h** is arranged across both the securing-plate-side first projecting portions **72g** viewed from the upper side. The securing-plate-side second projecting portion **72h** has a rect-

7

angular plate shape extending in the drum axial direction. The securing-plate-side second projecting portion **72h** is formed by folding the upper end portion of the securing plate **72**. In the securing-plate-side second projecting portion **72h**, a securing-plate-side second engaging hole **72k** passing through in the thickness direction (the up-down direction) is formed. To the second-assembly securing portion **72a** constituted as described above, the above-described second assembly **82** is assembled and secured as described later.

The following describes an assembly procedure of the paper separating device **31** to the drum frame **71** with reference to FIG. 13 to FIG. 15.

In the first step, two of the second assemblies **82** are prepared to be assembled to the second-assembly securing portions **72a** of the securing plate **72** (in the step on the upmost side of FIG. 13). In this assembly work, firstly, the second engaging claws **104** (see FIG. 14) formed in the holder **100** are engaged with the securing-plate-side second engaging hole **72k**. Subsequently, while the arm portions **102** of the holder **100** are pressed to the upper side with fingers and slightly bent, the first engaging claws **103** are inserted into the securing-plate-side first engaging holes **72j**. Subsequently, when the fingers are separated from the arm portions **102**, the arm portions **102** return to the original states by restoring force, and then the first engaging claws **103** are engaged with the securing-plate-side first engaging holes **72j**. Thus, the assembly of the respective second assemblies **82** to the second-assembly securing portions **72a** is completed.

In the next step, the securing plate **72** to which the second assemblies **82** are assembled is mounted on the securing-plate mounting surface **71f** of the drum frame **71** (in the step in the middle of FIG. 13). When the securing plate **72** is mounted on the securing-plate mounting surface **71f**, the frame-side first projecting portions **71g** that constitute the first-assembly securing portion **71c** pass through the insertion holes **72d** formed in the securing plate **72** and then are exposed outside. Additionally, the frame-side second projecting portion **71h** that constitutes the first-assembly securing portion **71c** projects from the upper side with respect to the upper end edge of the securing plate **72**, and then is exposed outside. That is, even after the securing plate **72** is secured to the securing-plate mounting surface **71f** of the drum frame **71**, the first-assembly securing portion **71c** is exposed outside without being hidden by the securing plate **72**.

In the last step, the first assembly **81** is assembled to the above-described exposed first-assembly securing portion **71c** (in step on the downmost side of FIG. 13). In this assembly work, firstly, the second engaging claws **104** (see FIG. 15) formed in the holder **100** are engaged with the frame-side second engaging hole **71k**. Subsequently, while the arm portions **102** of the holder **100** are pressed to the upper side with fingers and slightly bent, the first engaging claws **103** are inserted into the frame-side first engaging holes **71j**. Subsequently, when the fingers are separated from the arm portions **102**, the arm portions **102** return to the original states by restoring force, and then the first engaging claws **103** are engaged with the frame-side first engaging holes **71j**. Thus, the assembly of the respective first assemblies **81** to the first-assembly securing portions **71c** is completed. With the above-described three steps, the assembly of the paper separating device **31** to the drum frame is completed.

As described above, in the above-described embodiment, the paper separating device **31** includes the first assembly **81** that has both the paper separating function and the paper guiding function, and additionally includes the second assembly **82** that has the paper guiding function only. This can improve the conveyability (guiding performance) of the paper

8

sheet **P** after being separated from the circumference surface of the photoreceptor drum **21** by the separation claw **92**. Moreover, the above-described first and second assemblies **81** and **82** employ the same holders **100**. This can commonize components, thus reducing the product cost.

In the above-described embodiment, the second-assembly securing portion **72a** for securing the second assembly **82** is formed not in the drum frame **71** but in the securing plate **72**. This can separate the assembly step (in the step on the upmost side of FIG. 13) of the second assembly **82** and the assembly step (in step on the downmost side of FIG. 13) of the first assembly **81** into different steps. This can prevent the error in which the first assembly **81** is erroneously assembled to the second-assembly securing portion **72a** or the second assembly **82** is erroneously assembled to the first-assembly securing portion **71c**.

In the above-described embodiment, the second-assembly securing portion **72a** is formed in the securing plate **72** for securing the sealing member **73**. This can suppress the increase in the number of components using the existing securing plate **72**. This can reduce the product cost.

### Second Embodiment

FIG. 17 illustrates a second embodiment. This second embodiment is different from the above-described first embodiment in configuration of the securing-plate mounting surface **71f** of the drum frame **71**. In the following embodiment, like reference numerals designate corresponding or identical elements throughout FIG. 15 and FIG. 17, and therefore such elements will not be further elaborated here.

That is, in this embodiment, on the securing-plate mounting surface **71f** of the drum frame **71**, a pair of regulating portions **71p** is formed. The pair of regulating portions **71p** regulates the displacement of the first engaging claws **103**, which is formed in the holder **100** of the second assembly **82**, toward the engagement releasing side. The respective regulating portions **71p** are formed to project to the inside of the pair of through-holes **72m** formed in the securing plate **72**. The regulating portions **71p** are each arranged adjacent to the arm portion **102** of the holder **100** at the upper side within the through-hole **72m**. Accordingly, this regulating portion **71p** regulates the upward displacement of the arm portion **102**. Thus, the regulating portion **71p** regulates the displacement of the engaging claw **103** to the upper side (that is, the engagement releasing side). This can prevent the second assembly **82** once assembled to the second-assembly securing portion **72a** from being carelessly removed. Thus, this can reliably prevent the first assembly **81** from being erroneously assembled to the second-assembly securing portion **72a**.

### Third Embodiment

In the above-described embodiments, the examples where the paper separating device **31** is applied to the photoreceptor drum **21** have been described. This, however, should not be construed in a limiting sense. For example, the paper separating device **31** may be applied to the fixing roller (fixing drum) **40a** for heat fixing of toner to a paper sheet. In the above-described embodiments, the second assembly **82** is secured to the securing plate **72** and the first assembly **81** is secured to the drum frame **71**. This, however, should not be construed in a limiting sense. The first assembly **81** may be secured to the securing plate **72** and the second assembly **82** may be secured to the drum frame **71**.

While in the above-described embodiments the copier **1** has been described as one example of the image forming

apparatus, the image forming apparatus according to the disclosure is not limited to this. For example, another image forming apparatus such as a printer, a scanner device, or a multi-functional peripheral is possible.

As described above, the disclosure is effective for an electrophotographic system image forming apparatus with a photoreceptor drum, in particular, effective for an image forming apparatus with separating unit for separating a paper sheet from a photoreceptor drum.

While various aspects and embodiments have been disclosed herein, other aspects and embodiments will be apparent to those skilled in the art. The various aspects and embodiments disclosed herein are for purposes of illustration and are not intended to be limiting, with the true scope and spirit being indicated by the following claims.

What is claimed is:

1. A paper separating device comprising:

a frame member;

a rotating image carrier supported by the frame member for rotationally abutting contact on paper sheets;

assemblies, the assemblies being of two types,

a first assembly type including a separation claw configured to separate paper sheets from the image carrier, a guiding member configured to guide paper sheets in being separated from the image carrier by the separation claw, and a holder holding the separation claw and the guiding member, the holder having first and second engaging claws, and

a second assembly type including a duplicate of the guiding member of the first assembly type, and a duplicate of the holder of the first assembly type, but absent the separation claw of the first assembly type; and

an assembly-securing plate removably mounted on a mounting surface of the frame member, the securing plate having disposed thereon securing-plate-side assembly securing portions each including

a securing-plate-side first projecting portion and a securing-plate-side second projecting portion projecting from the securing plate and are spaced apart from each other,

securing-plate-side first engagement holes formed in the securing-plate-side first projecting portion as engagement portions for being engaged with the first engaging claws of the holder of either the first assembly type or the second assembly type, and

securing-plate-side second engagement holes formed in the securing-plate-side second projecting portion as engagement portions for being engaged with the second engaging claws of the holder of the first assembly type or of the second assembly type; wherein

the frame member includes, disposed on the securing-plate mounting surface of the frame member,

frame-side assembly securing portions each with engagement portions for being engaged with the first and second engaging claws of the holder of either the first assembly type or of the second assembly type, and

regulating portions, the regulating portions being configured to restrict engagement-releasing displacement of the first engaging claws of the holder of either the first assembly type or of the second assembly type; and

the assemblies of one of the two types are secured to the securing-plate-side assembly securing portions, while the assemblies of the other of the two types are secured to the frame-side assembly securing portions.

2. The paper separating device according to claim 1, wherein the assemblies of the second type are secured to the securing-plate-side assembly securing portions, while the assemblies of the first type are secured to the frame-side assembly securing portions.

3. An image forming apparatus, comprising:

the paper separating device according to claim 1; wherein the image carrier is a photoreceptor drum.

4. A paper separating device comprising:

a frame member;

a rotating image carrier supported by the frame member for rotationally abutting contact on paper sheets;

assemblies, the assemblies being of two types,

a first assembly type including a separation claw configured to separate paper sheets from the image carrier, a guiding member configured to guide paper sheets in being separated from the image carrier by the separation claw, and a holder holding the separation claw and the guiding member, the holder having first and second engaging claws, and

a second assembly type including a duplicate of the guiding member of the first assembly type, and a duplicate of the holder of the first assembly type, but absent the separation claw of the first assembly type; and

an assembly-securing plate removably mounted on a mounting surface of the frame member, the securing plate having disposed thereon securing-plate-side assembly securing portions each with engagement portions for being engaged with the first and second engaging claws of the holder of either the first assembly type or of the second assembly type; wherein

disposed on the securing-plate mounting surface of the frame member are

frame-side assembly securing portions each including a frame-side first projecting portion and a frame-side second projecting portion projecting from the frame member and spaced apart from each other, frame-side first engagement holes formed in the frame-side first projecting portion as engagement portions for being engaged with the first engaging claws of the holder of either the first assembly type or the second assembly type, and

frame-side second engagement holes formed in the frame-side second projecting portion as engagement portions for being engaged with the second engaging claws of the holder of the first assembly type or of the second assembly type, and

engaging-claw regulating portions, the regulating portions being configured to restrict engagement-releasing displacement of the first engaging claws of the holder of either the first assembly type or of the second assembly type; and

the assemblies of one of the two types are secured to the securing-plate-side assembly securing portions, while the assemblies of the other of the two types are secured to the frame-side assembly securing portions.

5. The paper separating device according to claim 4, wherein the securing-plate-side assembly securing portions each include:

a securing-plate-side first projecting portion and a securing-plate-side second projecting portion projecting from the securing plate and spaced apart from each other;

securing-plate-side first engagement holes formed in the securing-plate-side first projecting portion as the engagement portions for being engaged with the first

engaging claws of the holder of either the first assembly type or the second assembly type; and  
securing-plate-side second engagement holes formed in the securing-plate-side second projecting portion as the engagement portions for being engaged with the second 5  
engaging claws of the holder of the first assembly type or of the second assembly type.

6. The paper separating device according to claim 4, wherein the assemblies of the second type are secured to the securing-plate-side assembly securing portions, while the 10  
assemblies of the first type are secured to the frame-side assembly securing portions.

7. An image forming apparatus, comprising:  
the paper separating device according to claim 4; wherein the image carrier is a photoreceptor drum. 15

8. The paper separating device according to claim 5, wherein the assemblies of the second type are secured to the securing-plate-side assembly securing portions, while the assemblies of the first type are secured to the frame-side 20  
assembly securing portions.

9. An image forming apparatus, comprising:  
the paper separating device according to claim 5; wherein the image carrier is a photoreceptor drum.

\* \* \* \* \*